

# FIROUZI CONSULTING ENGINEER, INC.

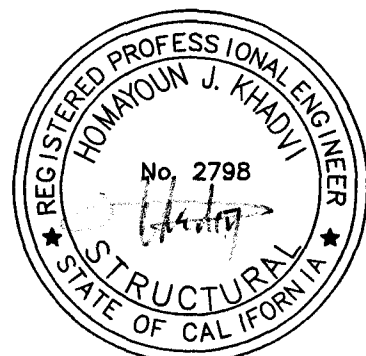
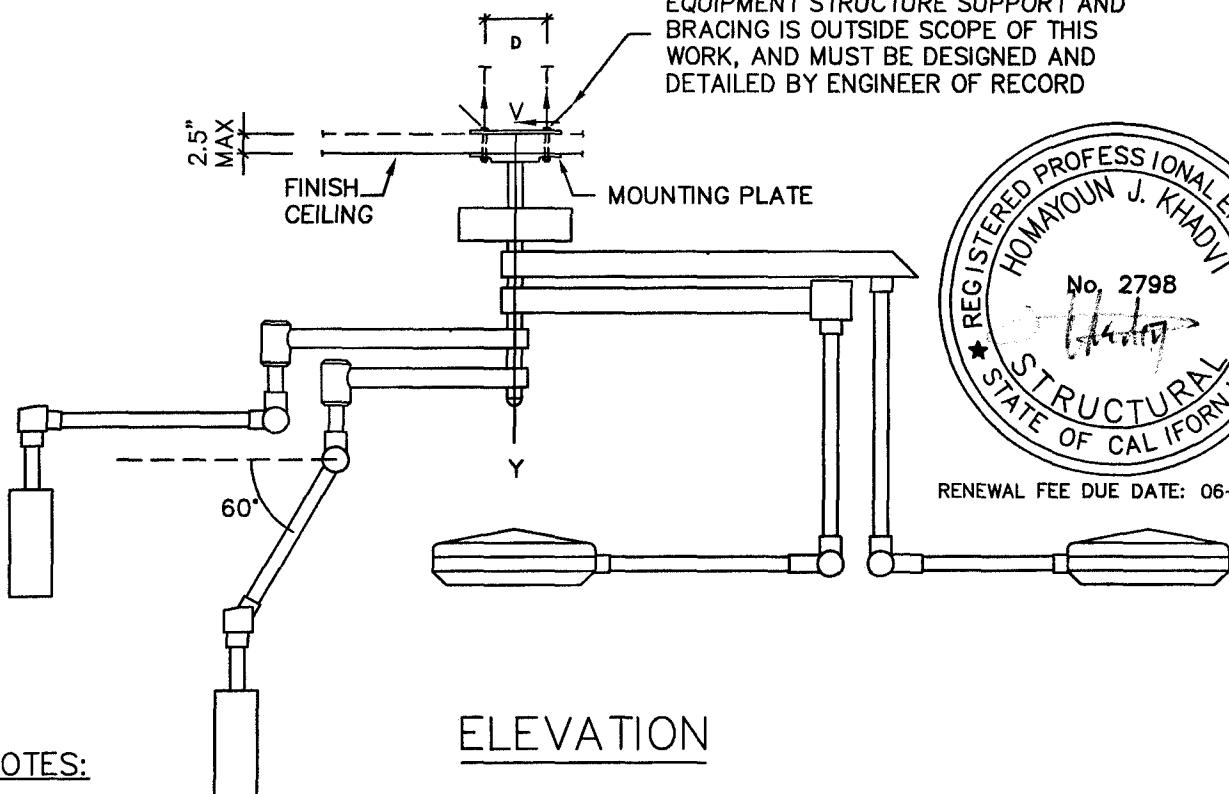
SKYTRON SURGICAL PRODUCTS	DES.	SHEET  <b>1</b>  OF 4 SHEETS
LFSLFSt23TV23 FOR SEISMIC ZONE (4), SOIL PROFILE (Sd) NEAR SOURCE FACTOR = 1.5	FCE JOB No.	
	DATE: 4-6-04	

## SEISMIC ANCHORING BOLT DESIGN

LFSLFSt23TV23

\*BY OTHERS:

EQUIPMENT STRUCTURE SUPPORT AND BRACING IS OUTSIDE SCOPE OF THIS WORK, AND MUST BE DESIGNED AND DETAILED BY ENGINEER OF RECORD



RENEWAL FEE DUE DATE: 06-30-06

ELEVATION

### NOTES:

1. SCOPE OF WORK: DESIGN OF BOLTS CONNECTING MOUNTING PLATE TO STRUCTURE ONLY.
2. FORCES ARE DETERMINED PER 2001 CALIFORNIA BUILDING CODE – SECTION 1632A, (INCLUDING UP TO DATE REVISIONS) AND HAVE BEEN FACTORED TO REPRESENT WORKING DESIGN LOADS, NOT ULTIMATE
3. FORCES ARE MAXIMUMS AND OCCUR WHEN EQUIPMENT IS MOVED TO ITS MOST ECCENTRIC POSITION.
4. PROVIDE CEILING STRUCTURE DESIGNED AND DETAILS TO SUPPORT WEIGHTS AND FORCES SHOWN (BY ENGINEER OF RECORD FOR THE BUILDING)
5. ENGINEER OF RECORD TO DESIGN, DETAIL AND VERIFY STRUCTURE AND/OR EXISTING LIGHT SUPPORT TRACTS TO SUPPORT INDICATED LOADS
6. HORIZONTAL FORCES AND MOMENT MAY OCCUR IN ANY DIRECTION, ACTING AT THE TOP OF MOUNTING PLATE.

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SKYTRON SURGICAL PRODUCTS	DES.	SHEET  <b>2</b>  OF 4 SHEETS
LFSLFSst23TV23 FOR SEISMIC ZONE (4), SOIL PROFILE (Sd) NEAR SOURCE FACTOR = 1.5	FCE JOB No.	
	DATE: 4-6-04	

## DESIGN CRITERIA:

FORMULA 32A-1:  $F_p = 4.0 C_a I_p W_p$

TABLE 16A-Q :  $C_a = 0.44 N_a = 0.44 \cdot 1.5 = 0.66$  ( For zone 4 & Sd)

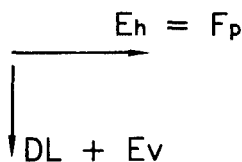
TABLE 16A-K :  $I_a = 1.5$  ( For essential facility)  
 $\therefore F_p = (4.0)(0.66)(1.5)W_p = 3.96 W_p$  (For LRFD)  
 $F_p = 3.96 W_p / 1.4 = 2.83 W_p$  (For ASD)

FORMULA 30A-1:  $E = p E_h + E_v$   
 $E_h = F_p$   
 $p = 1.0$  (FOR COMPONENT)

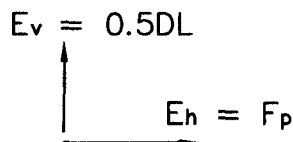
$$\begin{aligned} E_v &= (0.5) C_a I_p W_p \\ &= (0.5)(0.66)(1.5)W_p = 0.5 W_p \text{ (For LRFD)} \\ &= 0 \quad \text{(For ASD)} \end{aligned}$$

SECTION 1630A.11:  $E_v = (0.7) C_a I W_p$   
 $= (0.7)(0.66)(1.5)/1.4 = 0.5 W_p$  (For ASD) [NET UPLIFT FORCE]

## LOAD COMBINATION CASE A



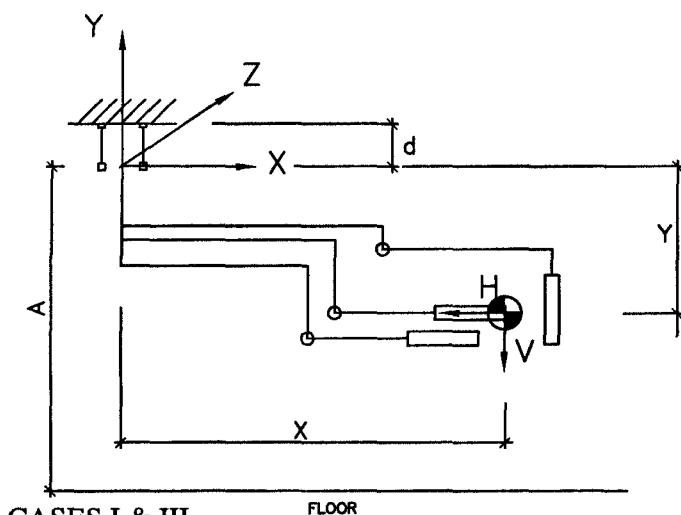
## LOAD COMBINATION CASE B



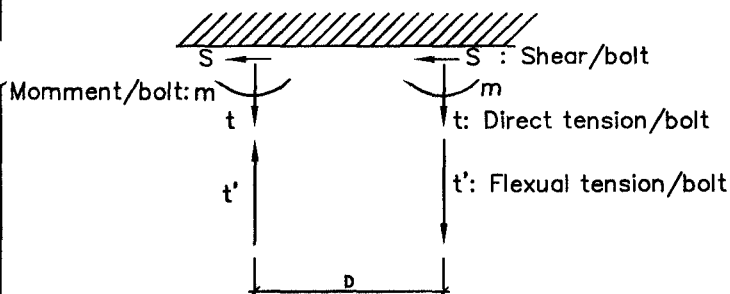
BY COMPARISON LOAD, COMBINATION A GOVERNS

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SKYTRON SURGICAL PRODUCTS	DES.	SHEET  <b>3</b>  OF 4 SHEETS
LFSLFSt23TV23	FCE JOB No.	
FOR SEISMIC ZONE (4), SOIL PROFILE (Sd) NEAR SOURCE FACTOR = 1.5	DATE: 4-6-04	



**CASES I & III**



A: MAX FLOOR TO MOUNTING PLATE  
DISTANCE

$$A = 10'-0" = 120"$$

Vd : Dead Load (= DL)

Ve : Vertical Seismic Load (= Ev)

He : Horizontal Seismic Load (= Eh)

## CASE I (FIXTURE AT HIGH POSITION)

$$d = 2.5"$$

$$D = 9.5"$$

$$Vd = 135.0 + 135.0 + 110.0 + 100.0 = 480.0 \#$$

$$Y = 120.0 - 80.0 = 40.0"$$

$$X = (135.0 \times 90.1 + 135.0 \times 82.5 + 110.0 \times 70.5 + 100.0 \times 62.8) / 480 = 77.8"$$

$$Ve = 0.50 \times 480.0 = 237.6 \#$$

$$He = 2.83 \times 480.0 = 1357.7 \#$$

$$S = 1357.7 / 4.0 = 339.4 \#$$

$$t = (480.0 + 237.6) / 4 = 179 \#$$

$$\text{Total } M_{zz} = (480.0 + 237.6) \times 77.8 + 1357.7 \times 40.0 = 110126 \text{ "#}$$

$$t' = 110126 / (9.5 \times 2) = 5796 \#$$

$$m = 339 \times 2.5 = 848.6 \text{ "#}$$

## CASE II (FIXTURE AT LOW POSITION)

$$d = 2.5"$$

$$D = 9.5"$$

$$Vd = 480.0 \#$$

$$Y = [(120.0 - 34.6) \times 135.0 + (120.0 - 34.6) \times 135.0 + (40.0 + 35.3) \times 110.0 + (40.0 + 35.3) \times 100.0] / 480.0 = 81.0"$$

$$X = [(50.6 + 39.5 \times \cos(60)) \times 135.0 + (43.0 + 39.5 \times \cos(60)) \times 135.0 + 35.3 \times 110.0 + 27.5 \times 100.0] / 480.0 = 51.3"$$

$$Ve = 0.50 \times 480.0 = 237.6 \#$$

$$He = 2.83 \times 480.0 = 1357.7 \#$$

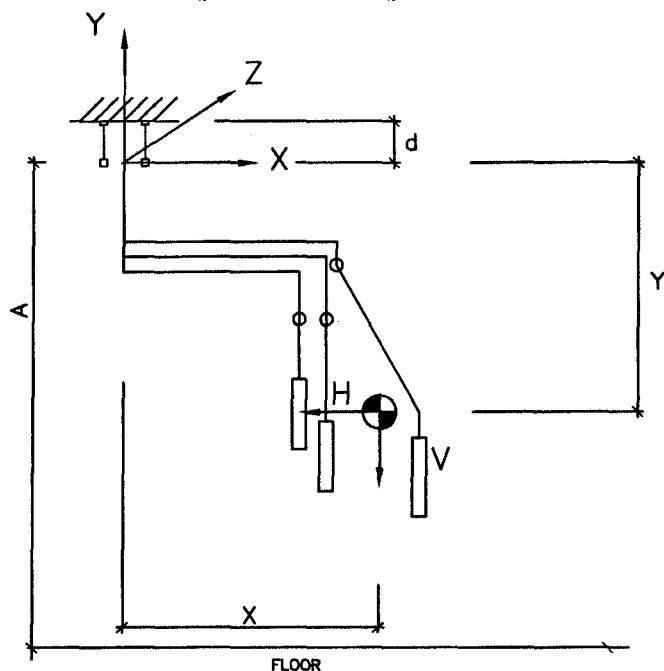
$$S = 1357.7 / 4.0 = 339.4 \#$$

$$t = (480.0 + 237.6) / 4 = 179 \#$$

$$\text{Total } M_{zz} = (480.0 + 237.6) \times 51.3 + 1357.7 \times 81.0 = 146729 \text{ "#}$$

$$t' = 146729 / (9.5 \times 2) = 7723 \#$$

$$m = 339 \times 2.5 = 849 \text{ "#}$$



**CASES II & IV**

# FIROUZI CONSULTING ENGINEER, INC.

SKYTRON SURGICAL PRODUCTS

DES.

SHEET

LFSLFSst23TV23

FOR SEISMIC ZONE (4), SOIL PROFILE (Sd)

NEAR SOURCE FACTOR = 1.5

FCE  
JOB No.

DATE: 4-6-04

4

OF 4 SHEETS

## CASE III ( Same As CASE I, Lateral Forces Applied Diagonally To Mounting Plate)

$$d = 2.5 \text{ "}$$

$$D = 13.4 \text{ "}$$

$$V_d = 480.0 \text{ \#}$$

$$Y = 40.0 \text{ "}$$

$$X = 77.8 \text{ "}$$

$$V_e = 0.50 \times 480.0 = 237.6 \text{ \#}$$

$$H_e = 2.83 \times 480.0 = 1357.7 \text{ \#}$$

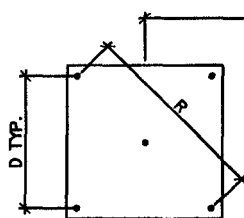
$$S = 1357.7 / 4.0 = 339.4 \text{ \#}$$

$$t = (480.0 + 237.6) / 4 = 179 \text{ \#}$$

$$\text{Total } M_{zz} = (480.0 + 237.6) \times 77.8 + 1357.7 \times 40.0 = 110126 \text{ \#"$$

$$t' = 110126 / (13.4 \times 1) = 8197 \text{ \#}$$

$$m = 339 \times 2.5 = 849 \text{ \#"$$



C.G.

CASES I & II  
D = 9.5"



CASES III & IV  
 $R = 9.5(2)^{0.5} = 13.4 \text{ "}$

## CASE IV

( Same As CASE II, Lateral Forces Applied Diagonally To Mounting Plate)

$$d = 2.5 \text{ "}$$

$$D = 13.4 \text{ "}$$

$$V_d = 480.0 \text{ \#}$$

$$Y = 81.0 \text{ "}$$

$$X = 51.3 \text{ "}$$

$$V_e = 0.50 \times 480.0 = 237.6 \text{ \#}$$

$$H_e = 2.83 \times 480.0 = 1357.7 \text{ \#}$$

$$S = 1357.7 / 4.0 = 339.4 \text{ \#}$$

$$t = (480.0 + 237.6) / 4 = 179 \text{ \#}$$

$$\text{Total } M_{zz} = (480.0 + 237.6) \times 51.3 + 1357.7 \times 81.0 = 146729 \text{ \#"$$

$$t' = 146729 / (13.4 \times 1) = 10921 \text{ \# GOVERNS}$$

$$m = 339 \times 2.5 = 849 \text{ \#"$$

CHECK 7/8" DIA. A490 BOLTS:

ALLOWABLE TENSION: 32500 #

ALLOWABLE SHEAR: 12600 #

$$S = 3.14 \times d^3 / 32 = 3.14 \times (0.88)^3 / 32.0 = 0.07 \text{ "3}$$

$$f_b = 848.6 / 0.07 = 12909 \text{ PSI}$$

$$F_b = 0.75 \times 36000 = 27000 \text{ PSI}$$

$$f_v / F_v + f_t / F_t + f_b / F_b = 0.03 + 0.34 + 0.48 = 0.84 < 1.0 \text{ OK}$$

USE 7/8" DIA. A490 BOLTS